



Communications Planner for Operational and Simulation Effects With Realism (COMPOSER)



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Alan J. Scrim - CERDEC

Chief, Spectrum Analysis & Frequency Management Branch

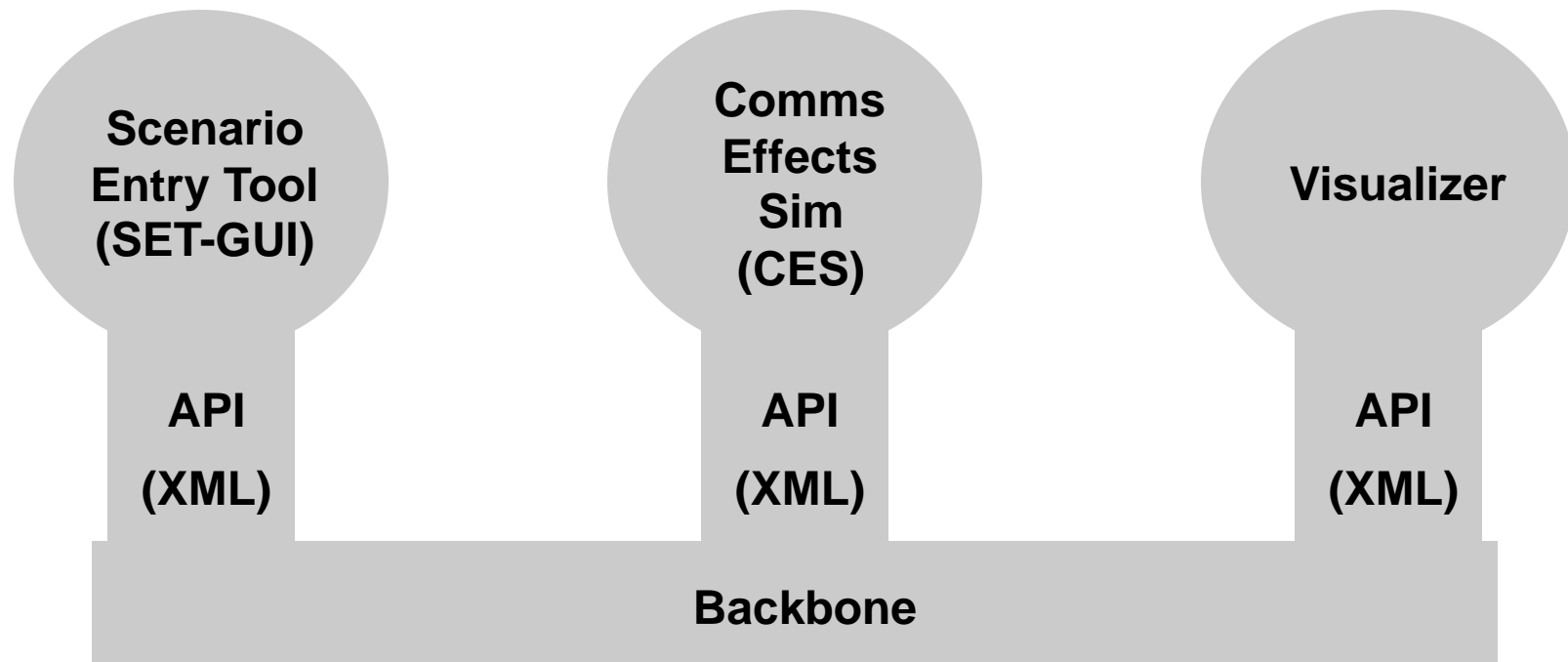
(732) 427-6346, alan.scrim@us.army.mil

Arne Bard - Booz, Allen and Hamilton

Carl Hein - Lockheed Martin Advanced Technology Laboratories

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Each of the components: CES, SET-GUI and Visualizer
is modular and can be used separately

- **Provide real time realistic communications effects for network operations planning and virtual exercises**
- **Simulates > 2 K radio nodes running > 600x faster than real time.**
- **Reduced Life cycle cost**
 - Government Purpose License Rights (GPLR)
 - No additional proprietary software required
 - Support available through CERDEC
- **Open architecture and Application Program Interfaces (APIs) that facilitates:**
 - Ease in adapting to support current force operations using a modern simulation tool
 - Reduces the time and effort to adopt new waveforms



COMPOSER VIDEO



File Edit View Tools Mouse Help

Mouse Profiles Terrain

v4.91

Platforms

Add Edit

Radios

Add Edit

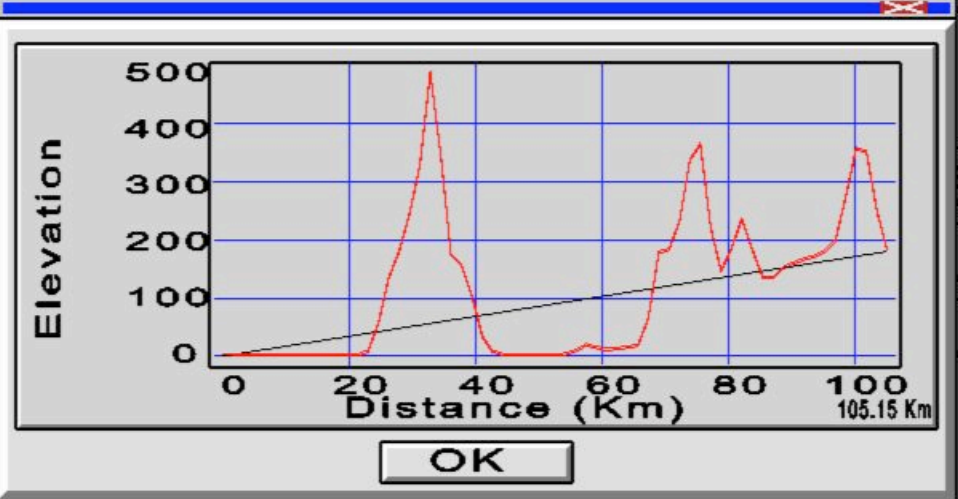
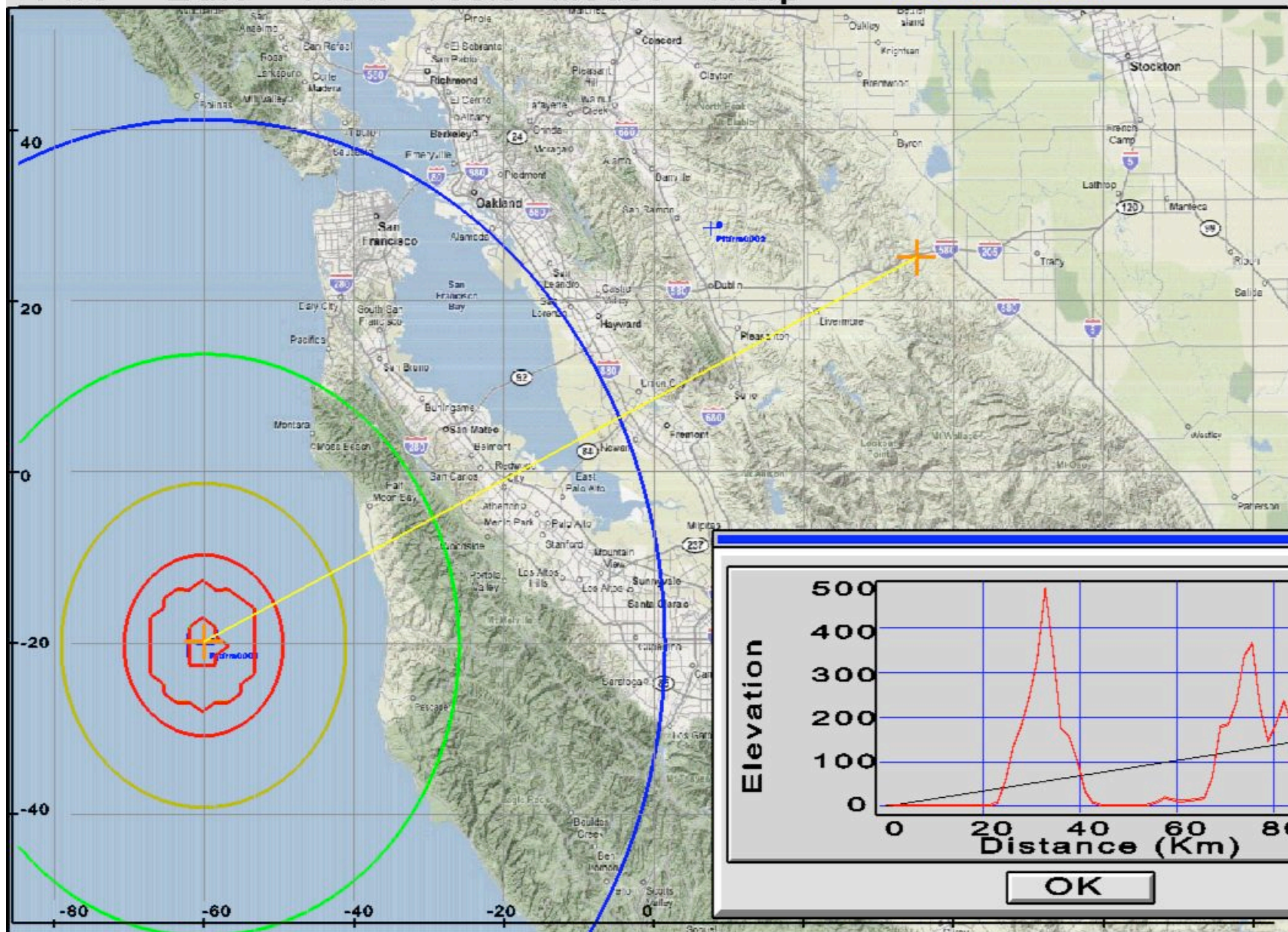
CommsTraff

Add Edit

Hide Paths

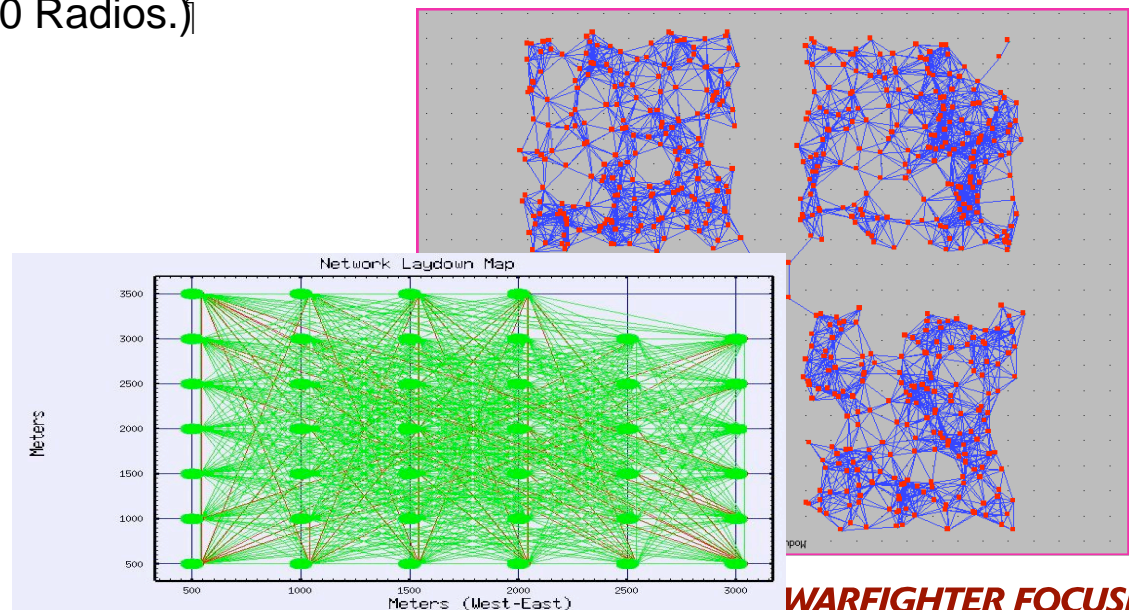
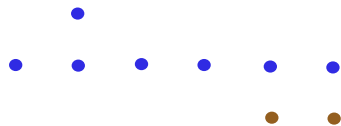
Zoom-In

Zoom-Out



Radios	RunDuration	Memory Usage	RunTime (secs)	Faster than Realtime
510	1 Hour		0.59	6,102x
1,020	1 Hour	19 MB	1.21	2,975x
2,020	1 Hour	40 MB	5.68	634x
4,040	1 Hour	82 MB	15.38	234x *

(* Requirement: 60x @ 4,000 Radios.)



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CES Radio Models



Radio Models

Abstract Level

Packet Level

Currently Supported:

WNW

X

X

802.11b

X

X

EPLRS

X

SINCGARS

X

SRW

X

Soon to be available:

HNR

X

NCW

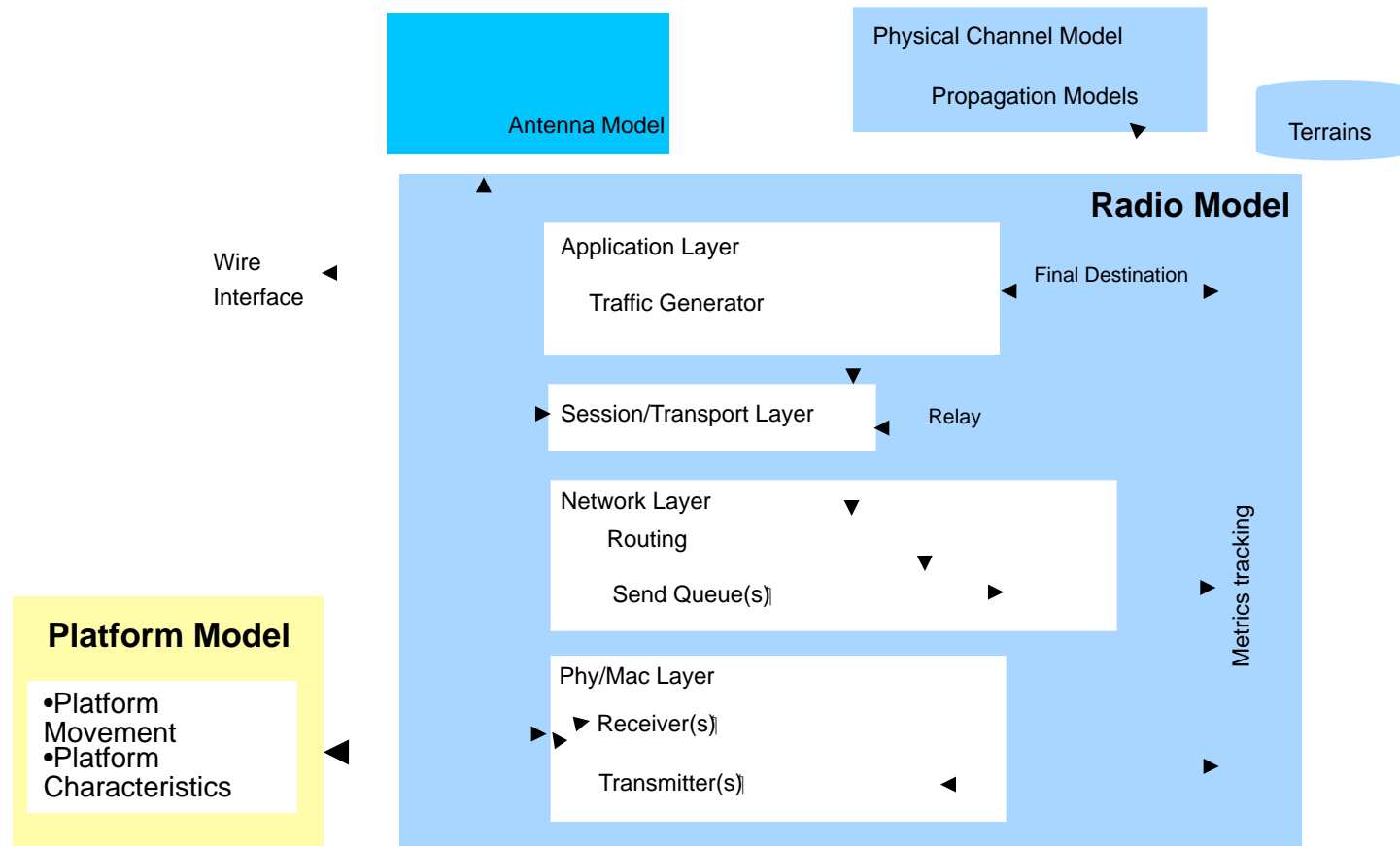
X

Full-featured radio-model:

- New radios can be added quickly by anyone.
- Network models are dynamic.
- Multiple abstraction levels – Packet level + Dynamic Traffic Flow



Other radio model instances



Metrics produced by CES:

Propagation:

1. Attenuation in dB due to distance and terrain between all transmitters and receivers at all times and positions.

Traffic:

1. Traffic generated, transmitted, relayed, and received by each radio-node, in bytes and messages.
2. Packets dropped by each radio-node.

Routing:

1. Routing path used by each message.

Metrics produced by CES (cont.):

Aggregated Measurements:

1. Total number of radios, nets (channel-groups or subnets), and radio-types.
2. Total Messages and MBytes of data Accepted for Transmission at source radios (insertion).
3. Total Messages and MBytes of data Transmitted, including source radios plus relay-hops.
4. Total Messages and MBytes of data Received at Destinations.
5. Aggregate transfer rate.
6. Transfer latency mean, peak, and variance (jitter).
7. Message Queue Length, mean and peak.
8. Number of hops, peak and mean.

Channel Metrics:

1. Utilization and fractional capacity versus time.

Metrics produced by CES (cont.):

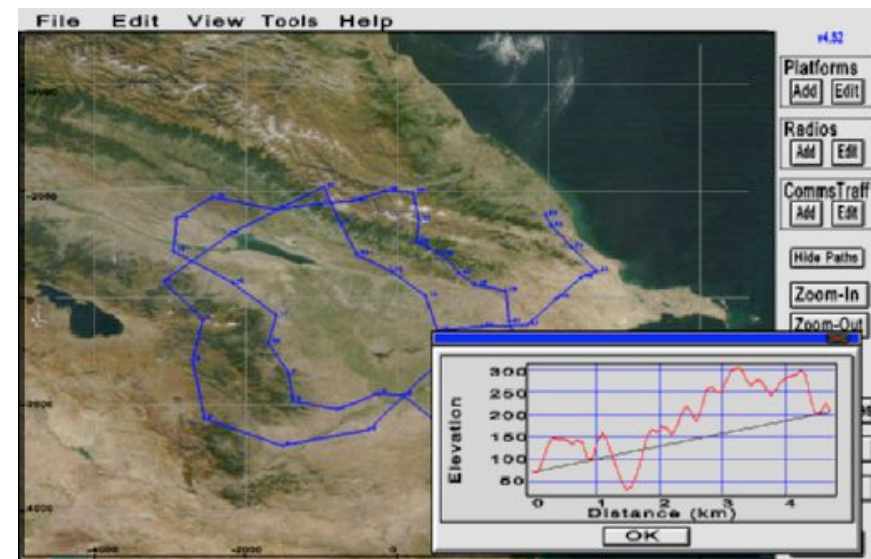
Plots:

1. Total Aggregate Traffic reaching destinations vs. Time
2. Total Aggregate Traffic requested (demanded-load) vs. Time
3. Total Aggregate Traffic inserted vs. Time
4. Message latency vs. Time
5. Queue depths vs. Time
6. Queue length histogram (length distribution across time)
7. Dropped packets versus time.

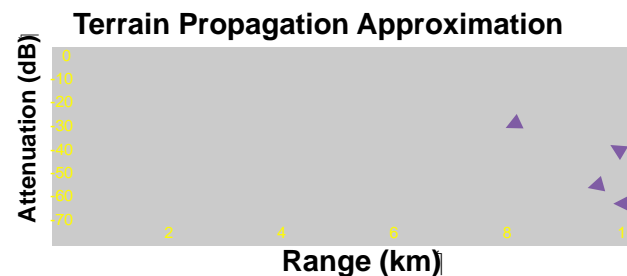
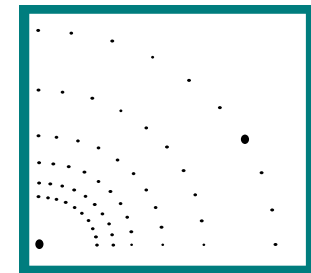
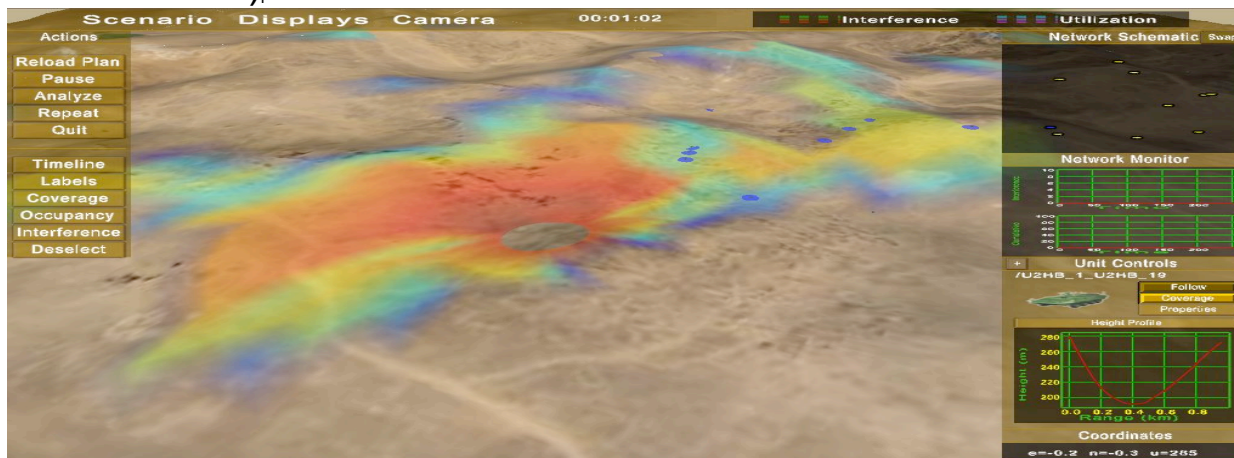
Additional data is collected in raw XML log files, and various additional statistics may be extracted.

Additional measurements can be tracked on request.

- **Range Functions: (For smooth earth, regular terrain)**
 - $1/R^2$ - free-space
 - $1/R^g$ - where g may range from 3 to 6, depending upon terrain and urban environment
 - * Okumura-Hata model
 - * Urban Propagation Model (planned)
- **Irregular Terrain Models**
 - Longley Rice (ITM)
 - TIREM (planned)
 - Log-polar interpolation – Caching
- **Rayleigh Fading**
 - Effect of multipath
 - Jake's model
- **Graphics Processor Unit (GPU) Based Methods**
 - Shading Language Based (in progress)
 - Collaborating with ACIN
- **Fast Spatial-hash Propagation Caching Reduces CPU Time by 5x**



- Log-Polar Fast Propagation
- Interpolative access routine extracts expected propagation between points in terrain
- Patent Disclosed
- Initialized by Longley-Rice ITM, TIREM, Actual Measurements, etc.
- Can address both terrain elevation and obscuration / absorption (weather/veg/structures)



ITM terrain model (truth)

Approximation (within 10dB)
Rayleigh fading range

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